ACS™ 1000

Aerosol Conditioning System

Studying the hygroscopic properties of aerosol particles offers insights into their effect on the Earth's radiative balance.

By simultaneously exposing aerosol particles to different relative humidity, the Acoem Aerosol Conditioning System ACS 1000 (formerly known as the Ecotech ACS 1000) enables the effect of water uptake on the particles' physical properties to be compared and measured in real-time by two instruments simultaneously.

OPERATION

The ACS 1000 can be fitted with a wide variety of sample inlets including PM_1, $PM_{2.5}$ or PM_{10}. Ambient air is drawn through the sample inlet and down through an unrestricted ball valve into the various modules.

Humidity reduction is performed using a permeation dryer which utilises a permeable membrane and a source of dry air. The dryer uses a single nafion tube which allows H_2O vapour to transfer from the inside of the membrane to the outside, removing it from the sample air. The large inside diameter of the membrane (40 mm) combined with the grounded mesh, minimises particle losses through the dryer.

Dry sample air passes through the inside of a Gore-Tex™ membrane while the outside of the membrane is filled with Milli-Q water.

As the water temperature is controlled to a higher set point, the amount of water vapour transferred inside increases, allowing the relative humidity of the sample air to be directly controlled.

CONFIGURATIONS

The modular design of the ACS 1000 gives the user flexibility, allowing for multiple configurations in terms of the type, number, and location of the drying and humidifying modules. Figure 1 shows the sample being split into two paths by an isokinetic flow splitter. The dry sample passes directly into one instrument for measurement while the other sample is humidified to a predetermined RH set by the controller and then measured. Alternatively each path's relative humidity can be stepped between 40 % to 90 % over a user-defined interval.

The ACS 1000 uses multiple temperature and relative humidity sensors located throughout the sample paths to continuously measure, control and record sample conditions. Additionally the system can be configured to run points and sequences manually or as a fully automated process. The microprocessor allows the operator to set key parameters for operation, such as:

- RH set points
- Ramp times
- Flow rates
- Auto calibration times.

The ACS 1000 is particularly useful when combined with a pair of Acoem Aurora™ nephelometers, due to its ability to directly communicate with them. However, it is designed to be used by many other types of aerosol instrumentation as well.

CALIBRATION

The ACS 1000 enables regular automatic zero and span checks, and calibrations to be performed on instrumentation.

During calibrations, the system automatically closes a ball valve to ensure air from the sample inlet is diverted directly to the exhaust pump, which maintains a constant flow at the sample inlet.

Performing a calibration will therefore not affect other instruments or create changes in flow.

SPECIFICATIONS

Sample residence time:	Up to 30 seconds at 1 l/min through humidifier
Flow control:	1 to 10 l/min per instrument
Sample relative humidity:	40 % to 90 % (dependent on dry compressed air RH)
Temperature sensor accuracy:	± 0.1 ˚C
RH sensor accuracy:	± 0.8 % RH (10 - 90 % RH)
Power supply:	110 - 250 VAC, 50 - 60Hz
User interface:	Backlit LCD & silicone keypad

COMMUNICATIONS & DATA STORAGE

- 2 x RS232 ports
- Digital inputs and outputs
- Analog inputs
- USB
- TCP/IP
- USB data storage.

INTERFACE TO EXTERNAL INSTRUMENTS

- 2 x RS232 ports (e.g. Aurora™ Nephelometers)
- External digital inputs/outputs & analog inputs.

OPTIONS

- Additional humidifiers, dryers & water reserves for customisable configurations
- PM_1, $PM_{2.5}$, PM_{10} inlets
- High flow pump
- Dryer assembly can be purchased as a stand alone unit.

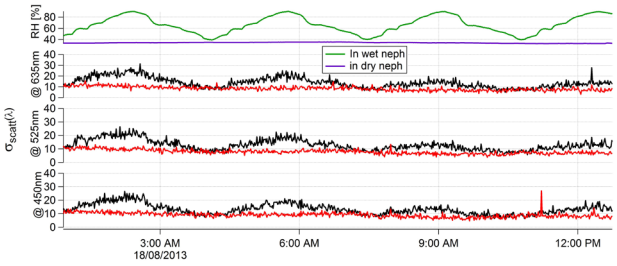

Figure 1. Top panel: RH measured in the dry and humidified nephelometers. Bottom three panels: Total scattering coefficients measured in the humidifier nephelometer (black) and the dry nephelometer (red) for the three available wavelengths.

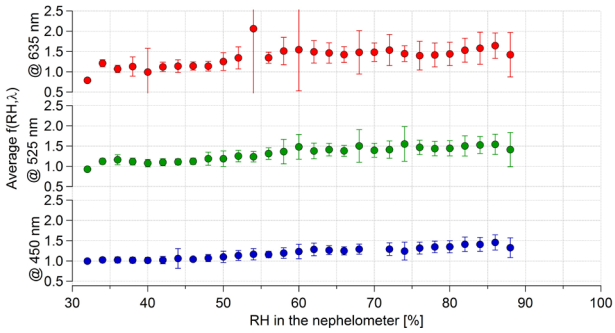

Figure 2. Particles total scattering enhancement factor as a function of RH in the humidified nephelometer.

1492 Ferntree Gully Road Knoxfield VIC 3180 Melbourne Australia
+61 3 9730 7800 email@acoem.com acoem.com

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ISO 45001 Occupational Health and Safety Management CERTIFIED